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ENGINEER CORPS U. S. ARMY

WASHINGTON, D. C.

INSTRUCTION BOOK
FOR
EXPORT PACKING OF ENGINEER
MATERIAL

107 Engineering Dept

ENGINEER CORPS U. S. ARMY

WASHINGTON, D. C.

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FOR
EXPORT PACKING OF ENGINEER
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PREFACE.

1. The problem of packing was studied with some care in the General Engineer Depot, and in November, 1917, Captain M. W. Hill was instructed by Lieut. Colonel Wheeler to collect and digest the data available. The General Engineer Depot published its "General Notes on Export Packing" in February, 1918. Captain Charles J. McIntosh was assigned as officer in charge of packing about March 1st, but in a few weeks was transferred for service with the Shipping Board and was succeeded by Major C. M. Goodrich, who continued in this duty until the fall of 1918, when Captain M. W. Hill again took it up.

2. The work in connection with packing was a part of the work of the Production Division of the General Engineer Depot; Lieut. Colonel Earl Wheeler was chief of this Division until May, 1918, when Major H. W. Eells succeeded him.

3. In June, 1918, the General Engineer Depot was ready to publish an elaborately revised and carefully studied specification on packing. This was, however, held in abeyance as the subject of packing was taken up by Dr. A. A. Hammerschlag, Chief of Research Branch, Purchase, Storage and Traffic Division, General Staff. As representative of the General Engineer Depot, Major Goodrich suggested to Dr. Hammerschlag that three men expert in packing problems, Mr. T. C. Morganweck of the International Harvester Co., Mr. M. C. Fitzgerald of the General Electric Co., Mr. D. L. Quinn of the Forest Products Laboratory, Department of Agriculture, be appointed as a committee. As a result of their work the boxing and crating specifications of the War Department, printed as parts 1, 2 and 3 herein, were finally published.

4. The specifications prepared by the General Engineer Depot were delayed until the specifications of the War Department were printed, and at that time it was the intention to publish these, together with those clauses in the specifications of the depot, which were not covered in the specifications published by the War Department. At this time, however, the major portion of the General Engineer Depot was transferred to the Office of the Director of Purchase, and under these changing conditions the printing of this booklet was again delayed. That portion of the General Engineer Depot which remained was re-named

Technical Engineer Design and Procurement Division, Corps of Engineers, U. S. Army, on November 19, 1918, and now prints herein both the specifications issued by the War Department and supplementary specifications which covered the clauses not included in the very excellent work of the committee named above.

PART I.

**STANDARD CRATING SPECIFICATIONS OF THE
WAR DEPARTMENT.**

PART I.

STANDARD CRATING SPECIFICATIONS OF THE WAR DEPARTMENT.

A crate consists of a frame with or without bracing. It may be of open construction or completely closed with sheathing. The lumber must be sound (free from decay and dote), well manufactured, and well seasoned. Frame and bracing must be free from knots greater than one-fourth the width of the face, and sheathing material must be free from knots greater than one-third the width of the boards measured as in Fig. O. No knot shall be permitted that interferes with nailing.

Methods of Measuring Size of Knot.

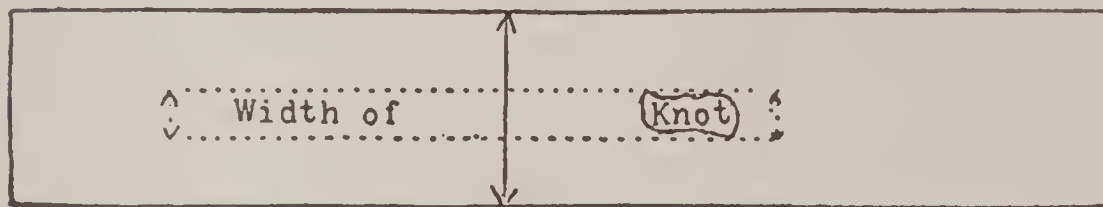


Fig. O

For these specifications well-seasoned lumber has an average moisture content of 12 to 18 per cent based on the weight of the wood after oven drying. To determine the moisture content weigh a piece of material before and after drying to a constant weight, dry at about 100° C. (212° F.), and divide the difference in the weights by the lesser $\times 100$.

The principal woods used for framing and for frame bracing and sheathing are grouped as follows:

Frames and Frame Braces.

GROUP I.

Alpine fir.	Cottonwood.
Aspen.	Cucumber.
Balsam fir.	Cypress.
Basswood.	Lodgepole pine.
Buckeye.	Noble fir.
Butternut.	Norway pine.
Cedar.	Magnolia.
Chestnut.	Redwood.

Spruce.
Sugar pine.
Western yellow pine.
White fir.

White pine.
Willow.
Yellow poplar.

GROUP II.

Ash.
Beech.
Birch.
Black gum.
Douglas fir.
Elm.
Hackberry.
Hemlock.
Larch.

Maple.
Oak.
Red gum.
Southern yellow pine.
Sycamore.
Tupelo.
Virginia and North Carolina
pine.

Sheathing.—Any species of wood may be used for sheathing.

Thickness of material.—When woods used for frames and braces in group 1 are 1 to 2 inches thick, woods in group 2 may be one-fourth inch less in thickness; when woods in group 1 are more than 2 inches thick, woods in group 2 may be one-half inch less in thickness.

Sheathing material of wood shall be approximately thirteen-sixteenths inch thick.

Widths of lumber.—Pieces less than 3 inches wide shall not be used in frames or frame braces. Pieces less than 2½ inches wide shall not be used in sheathing.

Nails.—All nails 20d. or less shall be standard cement-coated box nails.

In frames, frame braces, and sheathing the thickness of the member to be nailed on determines the penny of the nails used. In frame and frame braces the length of the nail should not be less than twice the thickness of the member nailed on. In sheathing the nails should be 2d. larger than the thickness of the member expressed in eighths of an inch.

Spacing nails.—Frames and braces shall not have less than two nails in each nailing edge. Nails in bracing and sheathing are to be staggered, approximately 2½ inches apart. Cross braces must have not less than two nails driven through the two pieces and these must be clinched where possible. Bracing should have as many nails as can be driven without splitting either member.

Bolts.—Bolts shall be used on heavy frame pieces, not less than two bolts to each framing edge. (See Fig. 2.) Standard cut washers shall be used under boltheads and nuts, except under heads of carriage bolts. Holes for bolts

shall be the same diameter as the bolts. Carriage bolts shall be used in preference to machine bolts. Not less than three-eighth-inch bolts shall be used for frames 1 to 1½ inches thick; one-half-inch bolts in frames up to 3 inches thick; five-eighth-inch bolts in frames over 3 inches thick.

Contents shall be bolted to skids with not less than four bolts where feasible, the size of the bolts to be determined by the holes in the machine base. When machine bolts are used, heads shall be counterbored flush with skids, and each bolt shall have a single-cut washer of standard size. The thread of bolts shall be upset close to the nut, so that the nuts will not work loose in transportation. To remove the nuts split them if necessary.

Designs of Crates and Crate Bracing.

The preferred design of crate construction is the three-way corner construction end in which are placed on the inside of the longitudinal members either the vertical or horizontal end members, whichever conserves the greater space. (See Fig. 1.)

On heavy articles skids should be at least 50 per cent thicker than the other members of the frame, the additional thickness to be in a separate piece bolted to the skids and extended to meet the vertical members. (See Fig. 3.)

Combined thickness of the cross braces shall equal the thickness of the frame members. (See Fig. 6.)

In angular crate bracing a cross member shall be placed so as to bring the angular brace as near 45° as possible. (See Fig. 8.)¹

On all heavy material each side of crate shall be marked so as to show the center of gravity and the skids shall be slotted on each side far enough apart to admit of proper

¹ The following rules indicate spacing for cross members and number of sections of angular braces:

Divide the longer dimension of the side or end to be braced by the shorter dimension.

1. If the result is less than 1½, use one angular or crossed brace (Fig. 5). Page 12.

2. If the result is 1½ or more and less than 3, use a cross member and two angular or crossed braces (Fig. 9).

$$8 \div 3 = 2.6.$$

Use cross member and two angular braces or use cross member and two crossed braces.

3. If the result is 3 or greater, use a number of angular or crossed braces equal to the first figure of the result and cross members to correspond, thus (Fig. 11).

$$14 \div 3 = 4.6.$$

Use four angular braces (or crossed braces) and three crossed members.

handling. Slots shall be at least 2 inches deep by 8 inches long, so that when the crate is being slung the hook on the hoisting point will span equally the center of gravity. (See Fig. 9.)

Internal Bracing.

Cleats of suitable length and thickness shall be used and shall be nailed or bolted to the skids at the base of contents so as to prevent longitudinal movements. All internal cleats and bracing, so far as possible, shall be so placed that the compression stress is against the end grain of the wood. (See Fig. 12.)

When contents have no base holes for bolting to skids, clamps must be placed at each end or side, fitted snugly to the load, and held in place by one bolt at each end. The clamps shall be full width of crate and of such square dimensions as will admit of no springing when bolts are drawn home. Such contents shall also have side cleats to prevent lateral movement.

Space for marking.—Some members of the crate shall be surfaced to permit adequate space for markings.

Exceptions to General Specifications.

In the designing of crates for the protection of contents the information given, with the explanatory drawings, is of a general character and covers in a general way all the material to be handled. There are, however, many exceptional cases where the material to be crated is of such a nature that it may be necessary to depart from these rules. All manufacturers contributing material for government uses should remember that conditions under which this material is handled are probably very much rougher and that the facilities for handling it are fewer than ordinarily is the case in export service. While the nature of the contents indicates the manner in which it is to ride, whenever possible material should be packed so that the package will rest safely on side, top, bottom, or end.

Strapping on crates.—In the use of strapping on crates there are so many forms, with such varied uses and functions, that it is not practical to lay down any fundamental rules to govern; yet straps are absolutely essential in certain cases, and must not be omitted in those instances, particularly at corners and at joints.

PART II.

**STANDARD BOXING SPECIFICATIONS OF THE
WAR DEPARTMENT.**

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STANDARD BOXING SPECIFICATIONS OF THE WAR DEPARTMENT.

Specifications for Nailed and Locked Cornered Packing Boxes.

It is the purpose of these specifications to make use of all the resources of the country with reference to boxing. The specifications are not intended to prevent the designation by a particular division of a specific box where only such a box meets the requirement for particular types of shipment, but in no case shall any type of box be designated exclusively unless it is the only one capable of use for the particular purpose. Where two or more types of boxes fall under these specifications, and such boxes are satisfactory for the particular type of shipment, the option of use shall lie with the shipper.

Methods of Measuring Size of Knot.

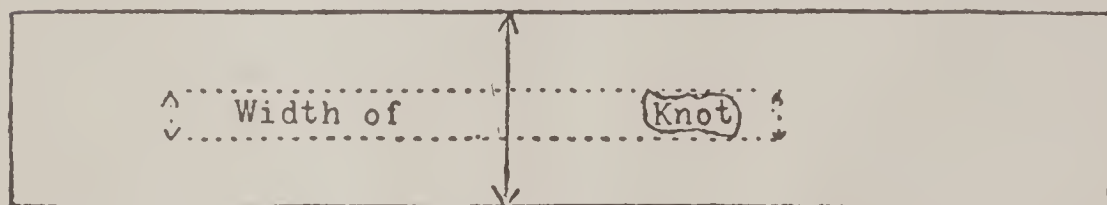


Fig. O

Where articles are controlled through exclusive patents, or other exclusive processes, no preference in purchasing or in specifications shall be adopted which gives such articles an exclusive position.

Where boxes falling within these specifications are manufactured or controlled through the use of patent rights or other exclusive processes, such boxes shall not be used unless provision is made by which these processes or rights shall in future be open equally to all manufacturers desiring to use them, under terms not in excess of those which have in the past been generally extended to the trade; this qualification to apply to all boxes to be used directly or indirectly by the United States Government during the duration of the war.

Nailed and locked corner boxes must be well manufactured from lumber which is sound (free from decay and

dote) and well seasoned. Lumber must be free from knot holes and from loose or rotten knots greater than 1 inch in diameter. Knots whose diameter exceed one-third the width of the board, measured as in Figure O, will not be permitted, and no knots will be permitted which interfere with the proper nailing of the box.

For these specifications well-seasoned lumber has an average moisture content of 12 to 18 per cent based on the weight of the wood after oven drying. To determine this moisture content weigh a piece of material before and after oven drying to a constant weight, dry at 100° C. (212° F.), and divide the difference in weights by the lesser $\times 100$.

The principal woods used for boxes are classed for the purposes of specifications in four groups:

GROUP I.

Alpine fir.	Noble fir.
Aspen.	Norway pine.
Balsam fir.	Magnolia.
Basswood.	Redwood.
Buckeye.	Spruce.
Butternut.	Sugar pine.
Cedar.	Western yellow pine.
Chestnut.	White fir.
Cottonwood.	White pine.
Cucumber.	Willow.
Cypress.	Yellow poplar.
Lodgepole pine.	

GROUP II.

Douglas fir.	Southern yellow pine.
Larch.	Virginia and Carolina pine.
Hemlock.	

GROUP III.

Black ash.	Pumpkin ash.	Tupelo.
Black gum.	Red gum.	White elm.
Maple, soft or silver.	Sycamore.	

GROUP IV.

Beech.	Hard maple.	Rock elm.
Birch.	Oak.	White ash.
Hackberry.		

Thickness of lumber.—Where woods in groups 1 and 2 are one-half inch thick and not less than three-eighths inch, woods in groups 3 and 4 may be one-sixteenth inch less in thickness; where woods in groups 1 and 2 are more

than one-half inch thick and not more than 1 inch, woods in groups 3 and 4 may be one-eighth inch less in thickness.

Width of lumber.—(a) Any end, side, top, or bottom 6 inches or less in width should be one-piece stock.

(b) No piece less than 2½ inches face width shall be used in any part except for cleats.

(c) The maximum number of pieces allowed in any end, side, top, or bottom more than 6 inches wide should be as follows (narrow pieces should always be placed in the center of the ends, sides, top, or bottom):

Width of face:	Maximum number of pieces.
Six inches and under.....	1
Over 6-10 inches, inclusive.....	2
Over 10-15 inches, inclusive.....	3
Over 15-20 inches, inclusive.....	4
Over 20-25 inches, inclusive.....	5
Over 25 inches.....	6

Surfacing.—All material must be surfaced one or two sides. When surfaced one side the surfaced side shall be the outside.

Joining.—Ends 1 inch or less in thickness should be either cleated or butt joined and fastened with not less than three corrugated fasteners, two driven from one side and one from the opposite side. Cleats should be not less than 2 inches wide and should have a minimum thickness of five-eighths inch. Triangular cleats of not less than three-fourths inch face measurement are permitted.

Nails.—All nails should be standard cement coated box nails. Plain nails driven through and clinched may be used for cleating.

The size of the nail shall depend upon the species and the thickness of the lumber in which the points of the nails are held.

When the nail specified for use under these specifications is not obtainable, use the next penny lower, and increase the number of nails in each nailing edge by one.

In groups 3 and 4 woods, the penny of the nail shall be the thickness of the lumber expressed in eighths of an inch. Groups 1 and 2 woods shall take the next penny larger.

Spacing of nails holding sides, top, and bottom to ends.—Six-penny nails and smaller: For 6-penny nails and smaller, space not more than 1½ inches apart when driven in the side grain of the end and not more than 1¼ inches when driven in the end grain.

Nails larger than 6 penny: The spacing of nails in end

construction may be increased from the above, one-fourth inch for each penny over 6.

Drive nails flush.

Spacing of nails holding top and bottom to sides.—Side nailing: When sides are one-half inch or thicker, space side nails approximately 6 inches apart.

Metal bindings.—All packing boxes for overseas service must be strap ironed. Strapping shall be cold rolled unannealed steel not less than five-eighths inch wide by 0.015 thick, treated to prevent rust, and shall have a tensile strength of not less than 850 pounds. The treatment must be of a character to prevent injury to strapping when bent or nailed.

Strapping placed at least 1 inch from each end is preferred, with double corner nails and such additional nails or staples holding straps to sides, top, and bottom as well minimizing festooning nails or staples spaced about 6 inches apart. (See Fig. 1½, sec. AA.)

Strapping must be drawn tight by mechanical means in order to have the maximum of tension.

Any metal or wire substituted for straps must be submitted to the War Department and approved prior to its use.

NOTE.—It is preferable to have ends and cleats made of woods of groups 3 and 4; side, tops, and bottoms may be of any species of woods in groups 1, 2, 3, or 4. Twenty-penny nails and over smooth nails may be used.

PART III.

**STANDARD SPECIFICATIONS FOR
WIRE-BOUND BOXES.**

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STANDARD SPECIFICATIONS FOR WIRE-BOUND BOXES.

Boxes must be well manufactured from lumber which is sound (free from decay and dote) and well seasoned. Lumber kiln dried at excessively high temperature or low humidities or below 6 per cent moisture must be avoided. Material must be free from knot holes and from loose or rotten knots greater than 1 inch in diameter. No knots will be permitted which interfere with the proper nailing or stapling.

Cleats.—Cleat material must be free from knots and cross grain. Cleats must not be less than three-fourths inch wide, seven-eighths inch thick.

Wires.—Wires shall not be less than No. 14 gauge nor spaced more than 6 inches apart.

Staples.—Staples shall be spaced not more than 2 inches apart over each wire. Staples which are not driven into cleats must be clinched.

Ends.—On boxes not to exceed 20 by 15 by 10 inches inside measurement and carrying not to exceed 90 pounds the ends may be the same thickness as the sheet material, and should be nailed or stapled on the inside of the cleats. Nails and staples shall be spaced approximately 2 inches apart. On larger boxes of heavier weights the ends shall be nailed to battens or to solid ends set between the cleats. A 7-penny nail must be driven through cleat into each end of each batten.

Number of pieces.—Sides and tops shall be one-piece stock, and bottom one or two piece stock if made of rotary-cut lumber not less than one-fourth inch thick. If two-piece sides and tops and three-piece bottoms are used, material must be at least one-thirty-second inch heavier than one-piece stock, or wires spaced not more than 5 inches apart.

When resawed material is used in sides, tops, and bottoms it shall be one-sixteenth of an inch thicker than the rotary-cut lumber specified for one-piece stock.

Limitations.—There are limitations as to sizes, weights, and commodities that can be packed in wire-bound boxes. These limitations, however, cannot be definitely fixed in any general specifications.

PART IV.

STANDARD SPECIFICATIONS FOR BALING.

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STANDARD SPECIFICATIONS FOR BALING.

1. Size of Bale.—Bales shall be made to conform to the following standard size: Length, 30 inches; width, 15 inches; height variable, but approaching 15 inches as nearly as possible, but not being less than 14 inches nor more than 19 inches; gross weight, 70 to 140 pounds.

The only exception to this rule will be when the material to be baled is of such size and weight that it is impossible or impracticable to make it into a bale of this standard size and weight.

2. Number of Articles Per Bale.—The purpose in baling is to pack the maximum number of articles in the minimum of space without damaging them.

3. Method of Folding and Forming Articles in Bales.—Care should be taken in folding and forming that articles will produce neat, uniform, and compact bales; care taken that joints be broken to avoid cutting of covering by straps.

4. Covering.—Bales shall be covered with burlap of weight not less than 10 ounces to 40 inches in width.

For the standard bale 30 by 15 by 14 to 19 inches, two pieces are required, each piece 50 by 40 inches wide. Larger sizes require corresponding larger pieces.

5. Interlining Paper.—Each bale shall have underneath the burlap a lining of waterproof paper.

The interlining paper shall conform to the following specifications:

60/60 Waterproof Kraft Wrapping Paper for Baling.

Weight.—Shall not be less than 330 pounds. (Two sheets 60-pound Kraft duplexed with asphaltum.) 36×50 —480 (24×36 —480, 160 pounds).

Stock.—Shall be 100 per cent sulphate pulp.

Bursting strength.—Shall be not less than 140 points. Bursting strength after exposure of the waterproofed side to 3 inches of water for three hours shall not decrease more than 25 per cent.

Water resistance.—The paper shall not wet or dampen through in ten days.

Waterproofing.—The paper shall be duplexed with and one surface waterproofed with asphaltum or its equal. The paper shall be flexible, but not tacky under ordinary weather conditions where a duplex paper is used.

Cohesion.—The piles shall not separate under service conditions.

Basis of purchase.—For 1,000 sheets 36 by 50.

Explanation of tests.—Bursting strength is determined with the Mullen tester or testing machine giving equivalent results, the paper clamped with the waterproofed side up. Water-resistance test to be made with a column of water 3 inches in height after the paper has been crumpled in the hand.

For the standard bale 30 by 15 by 14 to 19 inches experience has shown that it is desirable to have at least two sheets, each sheet 50 inches long and 36 inches wide. Larger sizes require correspondingly larger sheets. The sides of bales should be reinforced when necessary with fiber boards, $\frac{3}{8}$ -inch slats, or other light material to add protection and rigidity.

6. Banding.—The banding shall be of cold-rolled unannealed steel $\frac{5}{8}$ inch wide, not less than No. 26 gauge. It shall be painted or coated to prevent rust and shall have a tensile strength of not less than 850 pounds.

Not less than four bands shall be used on each bale. The two outside bands shall be placed approximately 4 inches from each end, and the intermediate bands shall be placed equidistant from each and from the end bands.

Bands shall be applied by a mechanical stretching tool and must be stretched so tightly that the compression of the bale will be held and that the bands will remain in place and not slip off over the ends of the bale.

7. Sealing of Bands.—The ends of bands shall be sealed with a metal sleeve or seal designed to be either punched or crimped. The breaking strength of the sealed joint shall not be less than 50 per cent of the breaking strength of the strapping.

Loose ends of bands shall be folded under, cut round, cut or broken off so that no spider is left projecting.

8. Sewing.—The burlap shall be sewed up with three-ply linen or twine of equal quality of not less than 40 pounds tensile strength. Bales shall be sewed sides and ends and each stitch shall be knotted, and stitches shall be not less than 2 inches in length.

9. Ears.—Not less than 5 inches of surplus burlap shall be gathered together on each of the four corners and securely sewed into “ears” for handles. All ends of twine shall be securely fastened.

10. Stenciling.—Stencil black, United States Army standard, must be used, and the marking shall be in letters or figures, as large as possible. (Note: See “Marking,” for composition of this stencil black).

PART V.
THE PROBLEM.

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THE PROBLEM.

Purpose.—The purpose of this little book is to furnish a guide for overseas shipments for Engineer Materiel.

We all want results, and prompt results. Hair-splitting is out of place; rules are worthless unless we use common sense in applying them; a reasonable compromise to avoid delay, or a change that is good, will be accepted.

Requirements: We want—

- (a) Safe delivery at destination.
- (b) Savings in shipping space and in weight.
- (c) Least cost.
- (d) Conservation of raw materials, where wartime demand exceeds the supply.
- (e) Salvage of packing material overseas; bolts, band iron, lumber, burlap for sandbags or camouflage.
- (f) Such packages as can be handled by one or two men, 75 pounds or 140 pounds; often the stevedores overseas are women.
- (g) Packages convenient for many transshipments, and for issue.
- (h) No packing at all where it isn't necessary.
- (i) Packages whose contents are hard to steal on the way.
- (j) Packages that can stand in the rain on the docks or one side of a railroad track without injury from rain or salt spray.
- (k) Packages that can be placed on any side or end, and have other packages piled on top.
- (l) Standard methods so long as convenient.
- (m) Marking that is complete and exact, and nothing else—no advertising.

Troubles.—There has been an increase of over 300 per cent in the loss and damage claims account of the railroads during the past ten years. At the depot's receiving yards of the United States coast there are gangs patching bad packages and entirely repacking others; this is due sometimes to criminally bad packing, sometimes to stupidity, occasionally to brutally bad handling.

Trash lumber is sure to break. Use strong material, not high-priced clear stuff.

Kegs with contents over 150 pounds generally break and the contents are lost or thrown into the water. Barrels worse than oil barrels are quite worthless; the chime always breaks unless protected.

Annealed steel bands stretch and become useless. Thin bands, or those insufficiently fastened, are torn off by other boxes dragged over them. Bands too near the end are torn off first. Bands put on loosely form loops and are very bad; set them up taut with a stretcher.

Good lumber badly fastened together makes a bad box or crate; usually the trouble is with too few nails, screws, bolts, or too little band iron. When in doubt, use more band iron and more nails. Cement-coated nails don't pull out; the others do.

Handling.—We have never packed well enough for peace times; now handling is rougher than ever before. Our packages may get a great many handlings—into storage from cars, out of storage into a car, on to a dock or lighter, on to a vessel; out of the vessel to a lighter, to a pile on a dock, to cars, into a main depot, to a car or truck, to another depot, to a truck, to where it is to be used.

In loading, packages are often slid down a long chute, to bring up with a bang at the bottom. Rough handling sometimes seems intentional, possibly to get a chance to steal the contents. When a steamer discharges or takes on cargo in rough water, a cargo net may be used; if so, several tons of boxes and bales are piled in the net, swung out on a derrick boom over the dock, or the hatch, or a violently pitching lighter, and when the net is within 10 or 15 feet of where the material is to go, the signal is given and down goes the load with a rush. The package at the bottom gets the full shock, and should withstand much bad treatment.

A valuable article should show its value in the kind of a box it has around it; it may then get better treatment.

Overseas.—We must think of the men who need what we are sending. We want to get the goods to them. We can replace the material lost by bad packing, perhaps, but we cannot replace the time lost nor the cargo space misused because we pack badly. We must design packages as we design machinery, with care and common sense, and try out if in doubt.

Study of the Problem.—All the branches of the War Department are studying this problem. The Quartermaster Department has saved millions of cubic feet of cargo space by baling everything possible; the Ordnance Department has saved space by better designs of ammunition carriers, of boxing and crating of all kinds; the Medical Corps has

saved labor, material and ship space by a careful study of shipping cases of special design. The Signal Corps and the Engineer Corps have done the same, knocking down and packing bulky shipments solid, using lumber and metal that can be used again overseas.

We have gone into ships, over docks, through storehouses and factories to look at packing; we have sat on wharves and watched unloadings and loadings.

The United States Government has a Forest Products Laboratory at Madison, Wis., and here the Box Laboratory has made thousands of tests on boxes and crates in machines built for the purpose.

Several big exporting companies have sent their experts to help us, men who have gone to Europe and South America and Asia, and pretty nearly everywhere, just to see how their packing came out, and how others packed goods, men who have studied the problem hard and who know how hard a problem it is.

Many manufacturers have helped us, told us our mistakes, acknowledged theirs, found new methods better than the old, talked it over with others, sent their packing men to other factories.

PART VI.

SUPPLEMENTARY SPECIFICATIONS FOR
PACKING FOR ENGINEER MATERIAL.

PART VI.

SUPPLEMENTARY SPECIFICATIONS FOR PACKING FOR ENGINEER MATERIAL.

Special Cases.

1. Where the method of packing is given on drawings or in sketches or other definite directions, such directions shall govern.

2. Packing not satisfactory shall be so changed as to meet approval, previous approval notwithstanding. The officer in charge will adjust with the contractor for any extra cost involved.

3. Old boxes, barrels or other old containers will not be used. Oil barrels or equal are excepted if in first-class condition.

4. When required in the order, approved seals will be placed upon the packages.

Bands.

5. Each case will be firmly bound with unannealed cold rolled strip steel. Ends should lap at least four inches. Care must be exercised in nailing not to injure contents of package.

6. Bands shall be drawn tight by mechanical means (see Figs. 16 and 17); the use of a hammer claw, and driving a nail on a slant and then straightening it up, are not satisfactory. The joint shall be on the side of the box or crate. The tools sketched are not patented.

7. Bands shall preferably be put on as late as may be before shipment, to minimize the effect of shrinkage.

Loads.

8. Where practicable the gross weight of a package shall be from 60 to 300 pounds. Convenience of storage, transfer, and issue to field forces shall be considered.

Shifting.

9. Heavy articles should be separated from light ones. When shipped in the same case a strong separate compartment should be used.

10. Cast pieces, which are liable to fracture, shall not rest together, but must be cushioned, or separated by wood brace, block or sheeting.

11. Cross timbers which hold heavy articles in place should be socketed at the ends (see Fig. 25) where there is danger of splitting if nails only are used.

12. Where light gray iron castings or breakable machine parts are near the outside of a package, brace the case so that there may be always 1-inch clearance between the articles and the case.

13. Articles subject to damage by moisture shall be adequately protected.

14. Cameras and photographic supplies requiring such treatment should be hermetically sealed, either in an asphalt treated cotton fabric (where necessary asphalt pitch sealed, lapping at last 6 inches) or in an approved waterproofed container, taped over the joints and with a coat of China wood oil over these.

15. For boxes weighing not over 200 pounds and of less size than 15 cubic feet, the forms shown in Figs. 18, 19, 20 and 22 will preferably be used. The three-way lock corner box is most dependable.

16. Corner posts are preferred in all packages over 300 pounds.

17. The size number and manner of applying bands are shown in Figs. 18, 19, 20, 22, 23 and 24. (See also general specifications.)

Wall Board.

18. Wall board will be packed as shown in Fig. 29. Only practically waterproof wall board will be used for covers.

Kegs for Steel Products.

19. Hardware, nails, bolts, etc., should be packed in small cases or kegs, made of first-class material, with heads reinforced by double heads, flush with the chime, with grain in the heads at right angles, well nailed together, banded with not less than four straps $\frac{5}{8}$ inch by .015 inch, secured in place by removing the two outer hoops, drawing the strips down and fastening them beyond the two hoops, after which the two hoops are replaced and secured in position.

Alternatively, the heads shall be secured by small strips of wood around the edge, called "head lining," and an approved steel cleat crossing the grain of the head and supporting it, such cleat to have ends extending under the end band and well down the sides and well secured.

20. The sides of the keg shall be of a suitable thickness of lumber, and, in addition to usual reinforcing around top and bottom, shall be bound firmly at top and bottom with a soft iron band or strap. Strap shall not be less than $\frac{5}{8}$ inch by .015 inch.

21. Where practicable, the weight of the keg and its contents shall be under 125 pounds.

Barrels for Steel Products.

22. Oil barrels, or equal, shall be used.

23. Wood filling will fill the end level with the chime and support it; its direction shall be across the board of the head. Inside the head a second head shall be placed, $1\frac{3}{4}$ inches thick, its boards extending at right angles to the boards of the head. The heads shall be carefully secured to the sides, at least three bands 1 inch by .030 inch will cross the head and be secured under two hoops at each end and to the sides.

Oils, Paints and Liquids.

24. Oils, paints and similar liquids will preferably be shipped in 50-gallon steel drums of not less than .0625 inch in thickness, or in tin containers as specified in paragraph 25.

25. When tin containers are used they shall be of heavy sheets, well made, rectangular in shape, hermetically sealed and securely packed in boxes or crates, with wood partitions between the containers. Containers will not exceed 5 gallons in capacity. Pack two 5-gallon containers in one box or crate.

26. Acid will be shipped in glass carboys crated in accordance with Fig. 30.

Switchboards.

27. Switchboards shall be packed in two boxes, the inner box being floated in the outer box, 3 inches clear space between, this space packed with excelsior. The inner box has supports; upon these is laid the switchboard with cigarettes between. These cigarettes are 2 to 3 inches in diameter, of excelsior rolled in paper; pieces are then forced down over the cigarettes and nailed to the sides. The inner box is completed, floated in the outer box, and this properly secured. (See Fig. 27 for heavy panels.)

Roofing Paper.

28. Roofing paper will be shipped in rolls, wrapped in stout paper well gummed down, with cloth pasted over the ends and on to the sides; or equal method. Roofing paper in rolls should be stacked on ends, and away from steam pipes.

Boiler.

29. Where there are no protuberances likely to be injured the depot may authorize shipment without crating; in this case the marking will be put upon the metal.

30. Tanks, boilers and similar material, where subject to damage if uncrated, will be shipped on skids or cradles, secured thereto by bands of ample strength provided with a turn buckle or satisfactory substitute; they shall be blocked against longitudinal shifting; the skids or cradles will present no sharp edges to the loads.

Heavy Wheels.

31. Heavy and large tractor or fly wheels will generally be shipped without crating or boxing. Hubs will be carefully protected, if necessary.

Shovels.

32. Shovels will be shipped in bunches of six securely wired together with annealed wire of not less than No. 12 B. W. G., the bowls will be nested, and the handles wired in two tiers of three each.

Machines.

33. Machines will preferably be shipped complete when weight and space occupied are not objectionable. Small and fragile parts will generally be demounted and packed with proper care, in a compartment built into the larger case. Other small detached parts should be bolted or securely fixed to the cross bars or supports, if not packed in a compartment of the main box.

34. When machinery is knocked down, dismantled parts will be marked with a number of ample size and easily seen. Bolts and screws will be greased and put back into their proper places. Each key will be taped in the key seat. Uncovered oil holes and tapped holes will be filled with pine plugs driven in to exclude dirt.

35. Ventilation shall be provided for heavy and large electrical machinery, and for other shipments where necessary.

36. Tongued and grooved lumber will generally be used where electrical machinery or other machinery is better protected by such means.

37. Exposed surfaces of machine parts shall be protected with a rust-preventing coating, free from acid, which expands easily, sets quickly to a sufficient firmness, and dissolves readily when wiped down with oil, turpentine or petroleum. Adequate wood covers or lagging will also be used when necessary.

38. Where bearings are used as supports, block supports are prepared (see Fig. 28); support points (1) will be slushed, (2) a zinc plate will be laid thereon, (3) carriage cloth or oil cloth will be laid on the zinc finished side to the zinc, and the other side slushed to receive the shaft.

39. Corrugated steel will generally be made into bundles of 200 pounds to 100 pounds by corrugated clamps of at least No. 14 B. W. G. in thickness; at least two will be used, not more than 36 inches apart; end clamps preferably about 1 foot from each end.

40. Rails will be shipped bare; splice bars preferably in pairs bolted together with their own bolts; fittings for rails preferably in boxes.

41. Unfabricated rolled beams, channels, angles, tees and similar material, including plates, not less than $3/16$ inch thick, will be shipped bare.

42. Shapes made of sheet steel or iron of No. 11 B. W. G. or less thickness will be nested and crated, unless this is held unnecessary.

43. Wire fence material will be made into tight rolls and securely wired, with wires about 6 inches from each end and not over 36 inches apart, not crated.

44. Fabricated structural steel will generally be shipped bare. Each piece will be marked as directed. Where projecting parts are likely to be injured, such blocking as will protect them will be placed, unless held unnecessary.

45. Machinery steel or tool steel will, where boxed or crated, have a 2-inch head, or better, at each end; this will be secured by two to four bands over the end. Short pieces will be blocked so as not to ram the ends. In packing this material use strips of soft wood about 3 inch by $3/8$ inch or $5/16$ inch between layers, at not less than two points, and at not less than one point for each 30 inches of length; band with 1 inch by .030 inch at each such point and at ends. The wood fillers crush and hold the bars in place. (See Figs. 20, 21.)

46. Steel pipe, when less than 2 inches in diameter, shall be bundled with not less than No. 12 B. W. G. annealed wire into bundles of preferably less than 200 pounds. Threads will be slushed and provided with a metal thread protector.

47. Steel pipe of 2-inch diameter or over shall be shipped bare. Threads shall be slushed and provided with a metal thread protector.

48. Window glass will be packed in straw, preferably rye straw, unthreshed, in such manner as to support the glass everywhere. Division strips will be used liberally. Extraordinary care is requested of the manufacturer. (Glass should be stowed vertical and athwart ship.)

49. Lamp and lantern globes will be shipped in boxes of not over 25 cubic feet, all dimensions approximately the same. Two inches of excelsior will separate the contents from the inside of the boxing; a flat double-faced corrugated board will separate layers. Incandescent lamps will be cased in corrugated paper cylinders, and placed so as to comfortably fill the layer; excelsior will be used where necessary for firm packing.

Alternatively, well-packed cartons will be boxed; a space of 2 inches clear between cartons and box will be filled with excelsior or similar material. The excelsior will be in a compact and even bed with no lumps.

Portable Buildings.

50. Buildings designed by the division shall be shipped as shown on the drawings and in the specifications.

51. Building designs submitted by others will include packing data with drawings and specifications accompanying; this subject will be covered in the order.

52. The following form will be signed by the packer, or the manufacturer's packing inspector, and attached to the packing list sent forward with each package:

I certify that the contents of this package
have been checked against the packing list
and carefully packed in this package for
overseas shipment.

.....
Packer (or inspector)

In case of bad packing or shortage the
manufacturer requests the return of this slip
with a statement of the shortage or of the
faults in packing.

.....
(Name and Address of Mfgr.)

Analysis of the Faulty Packing arriving at Ports of Embarkation based upon studies of 75 reports covering violations of instructions.

The percentages shown indicate the relative degree of faults and will probably represent average conditions in engineer shipments that fall under the complaint class. Increased information and education in scientific packing will gradually reduce the faulty class and the ratios of

the faults will probably alter in direct proportion as the ease of remedy is applied. Faulty marking, mailing and strapping are more easily remedied and will undoubtedly become more infrequent at a quicker rate than the use of bad lumber (which is not always under the packer's control) or the matter of design.

Per cent.

Improper design of box or crate to get best results	56
Waste space in box or crate, due to improper design	43
Strapping unsuitable or improperly applied.....	43
Marking incomplete or improperly done.....	51
Nailing bad, too few nails, improperly placed, etc..	52
Lumber, trashy, wormy, unsuitable for purpose.....	34

Notes on Baling—Engineer Branch.

Principal Item Baled, Sand-Bags.

500, Present Standard Bale (10 bundles, 50 bags).

Dimensions, 36 x 36 x 18; weight, 300 pounds.

Carload, 150 bales; 1,260 cubic feet.

Size of bag, 19 inches wide by 35 inches long.

Weight of bag, 9.6 ounces.

In presses three bales have been reduced in size to 38 x 27 x 22.

Bale of Ponton Covers:

5 covers per bale; weight, 620 pounds; 500 net.

Bale them boxed, dimensions 50 x 33 x 33; 31½ cubic feet.

Practically all covers now overseas.

Size Sand-bag changed recently. New bag, 25 inches long by 12½ inches wide; baled, 500 in bale, 25 x 25 x 18 inches; weight, net, 160 pounds.

Estimate of requirements, Req. 11 of 1918:

40,000 per month for each 25,000 men; 10,000,000 have already been contracted for. Present approximate estimate of monthly requirements, 23,000,000. This small bag weighs 5 ounces, and is made from 26-inch burlap folded in half and sewed one side and one end. Estimated monthly tonnage and cubage, 3,400 tons—275,000 cubic feet.

British are using 9-ounce burlap in their sand-bags. These bags are approximately 50 per cent larger than our 25-inch by 12½-inch bag. The French are about the same size as the British.

Can use any weight burlap that can be worked over into approximately the 25-inch by 12½-inch bag size.

Canvas, duck, ticking, etc., is being shipped in rolls and bales depending on the width of material and the purpose for which it is needed.

♥ Camouflage duck rolls are 72 inches wide and approximately 15 to 18 inch diameter, waterproof paper wrapped and then sewed up in burlap, no crating or boxing being used.

Other similar material is being bought in 36-inch widths. This is sewed together to make the 72-inch width and this style shipment is folded on itself and baled in standard units 36 x 36 x 30 approximately, weighing 300 pounds, containing a maximum yardage of 286 yards of 73-inch 16-ounce duck; 3,000,000 under contract.

These bales and rolls are being strapped with double wires, the bales with three double wires each way, sides and ends, and the rolls are banded, this being done in New York and not at the mills.

PART VII.

STANDARD MARKING SPECIFICATIONS.

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1. The following standard markings shall be used on all freight packages intended for oversea shipment to the United States Expeditionary Forces overseas, including packages accompanying troops, and on all tags and labels attached to packages, with the exceptions noted in paragraphs 13 and 14.

Standard Markings.

1. Country of debarkation.—All packages to be shipped overseas to the American Expeditionary Forces shall, before shipment, be marked in the center of the face of package with the letters "A. E. F." in equilateral triangle, thus:

A
E F

Each side of the triangle shall be approximately one-fourth the width of the marking surface, but shall not on any package exceed 24 inches.

2. Port of embarkation.—This shall be the name of the United States port through which the supplies are to be shipped overseas. Indicate by marking above the triangle, thus: "Via New York, Bush Terminal," or "Via Philadelphia, Pier 38," etc.

3. Shipments to specific depots or organization units.—This shall be the name of depot or organization unit to which the supplies are to be delivered overseas and shall be used only when a package is intended for a specific organization or is assigned to a port of debarkation for a specific purpose. Indicate by marking below the triangle, thus: "Ordnance Base Depot," "Motor Transport Repair Shop," "Air Service," etc.

4. United States number.—This shall be the number officially assigned to a shipment by the Embarkation Service or such other agencies as may be empowered by the Embarkation Service to designate such numbers. The United States number shall consist of five parts:

- (a) The letters "U. S." indicating United States property.
- (b) Figures representing the month and day of month.
- (c) A code letter (or letters) indicating the organization unit originating such number.

(d) Three figures indicating the number of the shipment authorized during a day, each day's designations commencing with "001."

(e) A package number, separated from preceding figures by a dash "—," the packages in each shipment being numbered from 1 up.

For example: U. S. 601 x 327—14 would represent the 327 shipment authorized by the Embarkation Service (indicated by "X") on June 1, and the 14th package of that shipment. If the first part of the number were U. S. 1214, etc., it would indicate a shipment authorized on December 14. This number need not be marked on packages containing subsistence supplies or ammunition, but shall appear on all transportation papers relating to such commodities. Indicate by marking this number in its entirety in upper right-hand corner of face of package or tags.

5. Group (lot) and package numbers.—These shall be used only when it is necessary or desirable that a number of packages, all forming a part of the same group, should be forwarded together. The group number (which may or may not be the shipper's serial number) shall be assigned by the original shipper and shall definitely identify the particular group. Indicate by marking in the lower right-hand corner of face of package the word "group," and immediately thereunder the group number, followed by the package number and the number of packages. All packages included in a group shall be given a consecutive package number, which shall be marked above the total number of packages in the group, thus:

Group
1201—16-18.

which indicates package number 16 of 18 packages included included in group No. 1201. Group (lot) number may, in addition, be placed on the ends of the cases if desired.

6. Weight.—This shall be the total weight in pounds when package is complete for shipment. Indicate by marking in the lower left-hand corner of face of package or tags, thus: "226 pounds." Weight need not be marked on packages containing subsistence supplies.

7. Cubic volume.—This shall be the cubical displacement of package when complete for shipment. Indicate by marking the nearest whole number of cubic feet in the lower left-hand corner of face of package immediately beneath the weight of package, thus: "64 cu. ft." Cubic displacement need not be marked on packages containing subsistence supplies.

8. Corps number.—This is the requisition, item, contract, order, invoice, or manifest number, or such combination thereof as may be designated by the respective corps. Indicate by marking such numbers in the upper left-hand corner of face of package or tags. Corps numbers need not be marked on packages containing subsistence supplies.

9. Corps insignia or symbol.—This is the insignia of corps to which the shipment is to be forwarded. Indicate by marking such insignia on both ends of packages or on reverse side of tags, except that on subsistence supplies a crescent shall be marked instead of the corps insignia. When a corps uses a distinctive symbol (e. g., the red cross of the Medical Corps) such markings may be used either in addition to or in substitution for the corps insignia.

10. Description of contents.—This is the quantity and description (name, size, style, etc.) of each article contained in package. Indicate by marking on both ends of package, at top or on reverse side of tag thus: "100 pr. field shoes, No. 2," "Standard kit No. 12," "Standard chest A," etc. When there are in one package a number of different articles or a number of different sizes of the same kind of article, the contents must be listed on a "Packer's List," which shall be either (a) applied on both ends of package in accordance with instructions for pasting waterproof bales, or (b) placed in moisture-proof envelopes attached to both ends of package.

11. Name of shipper.—This is the name of depot, contractor, quartermaster, or other person by whom the supplies are forwarded. Where supplies are shipped by a United States inspector at point of production, the name of producing contractor shall be shown as shipper. Indicate by marking below insignia or symbol on both ends of package or on reverse side of tags, thus: "From John Doe & Co." When supplies are stored temporarily in assembly depots the symbol of the depot, preceded by the word "thru," should be placed beneath the manufacturer's name.

12. Date of delivery.—This is the date of original delivery to the United States Government. It shall be used only on packages of subsistence or other perishable supplies. Indicate by marking month and year of such delivery immediately above the name of shipper on both ends of packages or on reverse side of tags.

13. General supplies (other than subsistence supplies).—All standard markings shall be used on general supplies, except marks (2), (3), (5), and (12), which shall be used only when these apply. Parts of machinery, structural shapes, and similar material will be marked as prescribed in each particular instance according to prearranged schedules of

packing. Metal tags containing information necessary for the rendering of proper reports of loading and arrival at docks will be attached invariably to such commodities. The standard markings shall be applied to ammunition and ammunition components as far as possible, subject, however, to such special markings and designs as their particular nature and use require.

14. Subsistence supplies.—The standard markings shall be applied to subsistence supplies as under—

Marks (1), (9), (10), (11), and (12) shall always be used.

Marks (2), (3), and (5) shall be used when these apply.

Marks (4), (6), (7), and (8) need not be used.

15. General instructions relating to marking—

No advertising matter shall appear on packages.

Stenciling is preferable to hand marking. The height of letters shall conform to the size and character of package, but shall not be less than $\frac{3}{4}$ inch. When marking with stencils, use only United States Army stencil black standard paint of the following composition:

Pigment, 50 per cent.

Liquid, 50 per cent.

Pigment shall consist of:

Drop black, 50 per cent.

Calcium carbonate, 50 per cent.

Liquid portion shall consist of:

Varnish, 70 per cent.

Combined dryer and thinner, 30 per cent.

The thinner shall consist of turpentine or volatile mineral spirits or a mixture thereof.

Special Requirements.—The paint shall dry rapidly to a flat surface that hides well.

The varnish should be a clear spar varnish. For bales or crates use the standard system of marking. For marking machinery carts, structural steel, or similar commodities, use United States standard paint, either white or of the corps color.

On small boxes not returnable and not to be reused, markings may be applied in the form of printed labels marked with waterproof ink in letters not less than $\frac{1}{4}$ inch high. At least two labels, containing all markings should be glued to each package, one on each end. Such labels to be made of sulphite paper, sulphate kraft paper, or other approved paper, and should be applied with hide glue, fish glue, or casein glue. After being glued, the addressed label should be brushed over with a coating of formaldehyde.

Where no containers are used for shipment, as in the case of a chassis or body of an automobile or a complete automobile, machinery parts, structural steel, etc., at least

two rough cloth or metal shipping tags (approved by the respective corps) shall be attached to each article by wire. Entries shall be made on such tags in accordance with the standard markings. These shipping tags are required in addition to any corps, section, or service name, or any data printed, perforated, or otherwise marked on motor vehicles or similar equipment.

In all cases where, as a means of saving space, articles are packed in or along with other articles, all packages in each shipment should be marked or tagged in accordance with instructions for marking overseas shipments, and a complete list of contents should be noted on the packer's list. The packages should be numbered and the packing list bearing the same number should go with the ship manifest.

16. Duplicate markings.—There should be inclosed within each package a card of sufficient size on which shall be recorded in legible characters all the standard markings, established by this general order, appearing on the face and ends of the package, so that if all or any of the exterior markings are obliterated or defaced, the package will contain ample directions to insure delivery to its proper destination. Whenever boxes or bales are packed by manufacturers for shipment to assembly depots and it is impossible to furnish instructions as to the final destination, the duplicate markings called for in paragraph 16 will only apply to the package list, to avoid reopening of the box at the intermediate shipping point.

2. Copies of the foregoing instructions shall be furnished each shipper in ample time for use in making his initial shipment.

3. A letter of instructions in regard to each shipment, in form substantially as follows, shall be sent the shipper by the War Department bureau concerned:

Address reply to _____ (Date) _____

And refer to _____

From: _____

To: _____

Subject: MARKING INSTRUCTIONS FOR OVERSEA SHIPMENTS.

(1) The markings on reverse side hereof are to be shown on each package contained in your shipment of _____.

(2) Please notify _____ when shipment is made.

(3) For further information, reference should be made to the detailed instructions relating to the marking of supplies to be shipped overseas, copy of which has already been sent you.

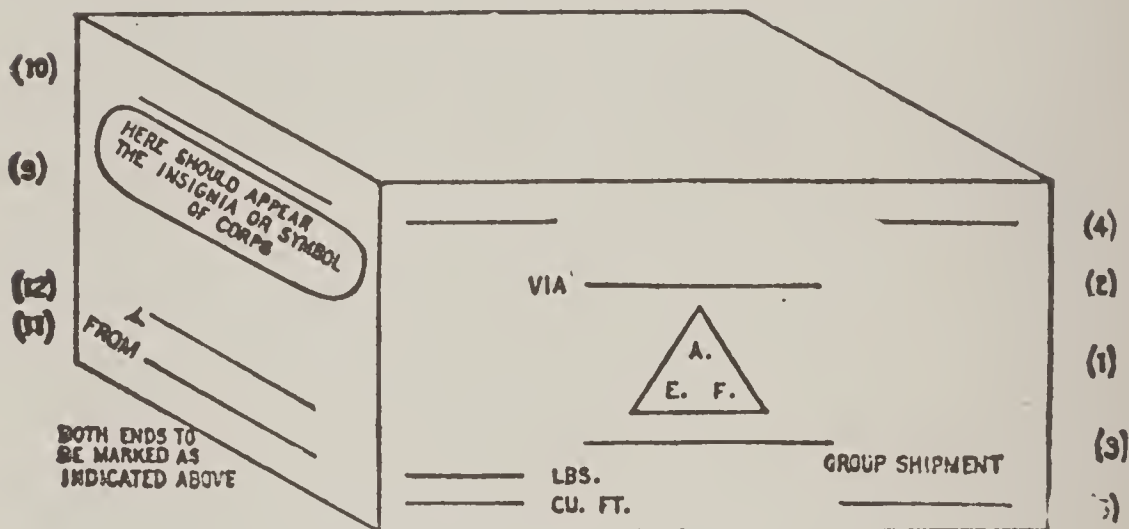
(4) Kindly furnish this office with _____ copies of shipping list.

By direction (or authority) of

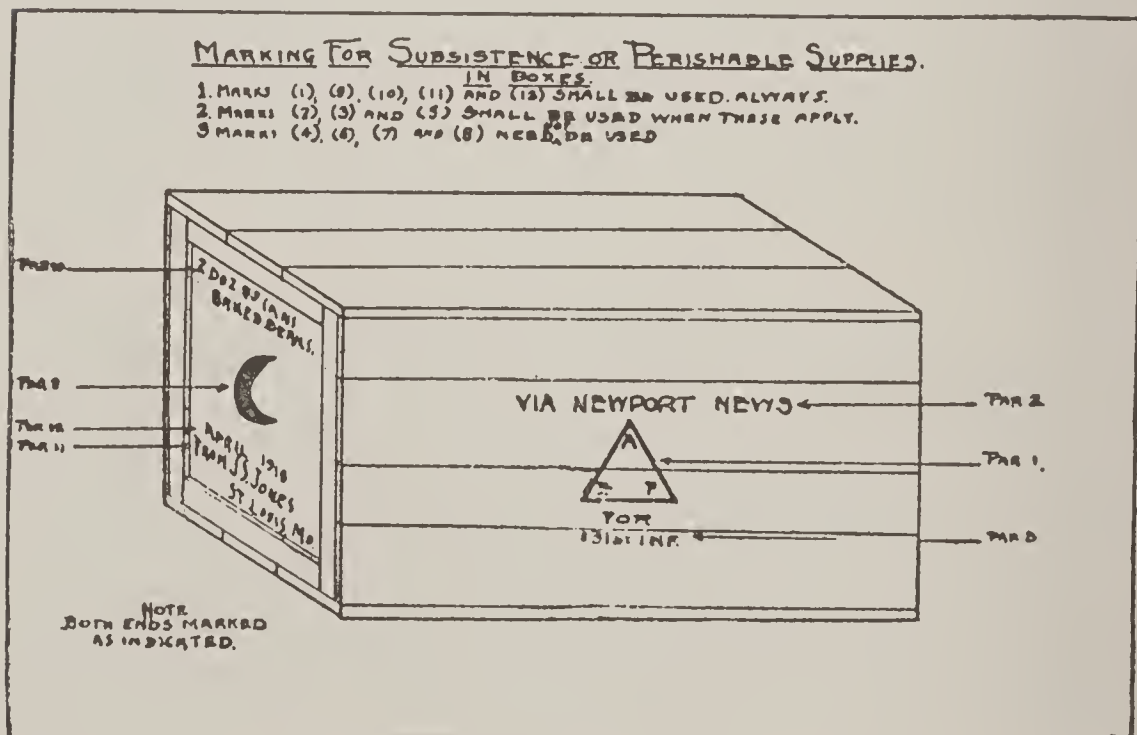
.....

.....

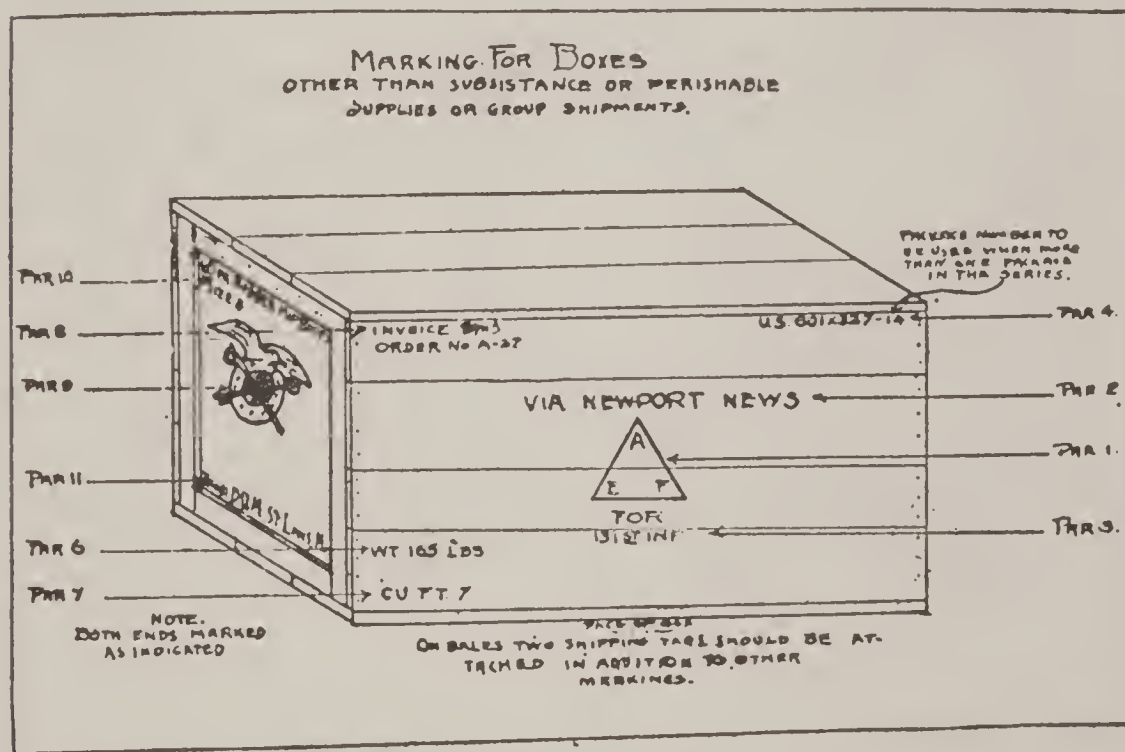
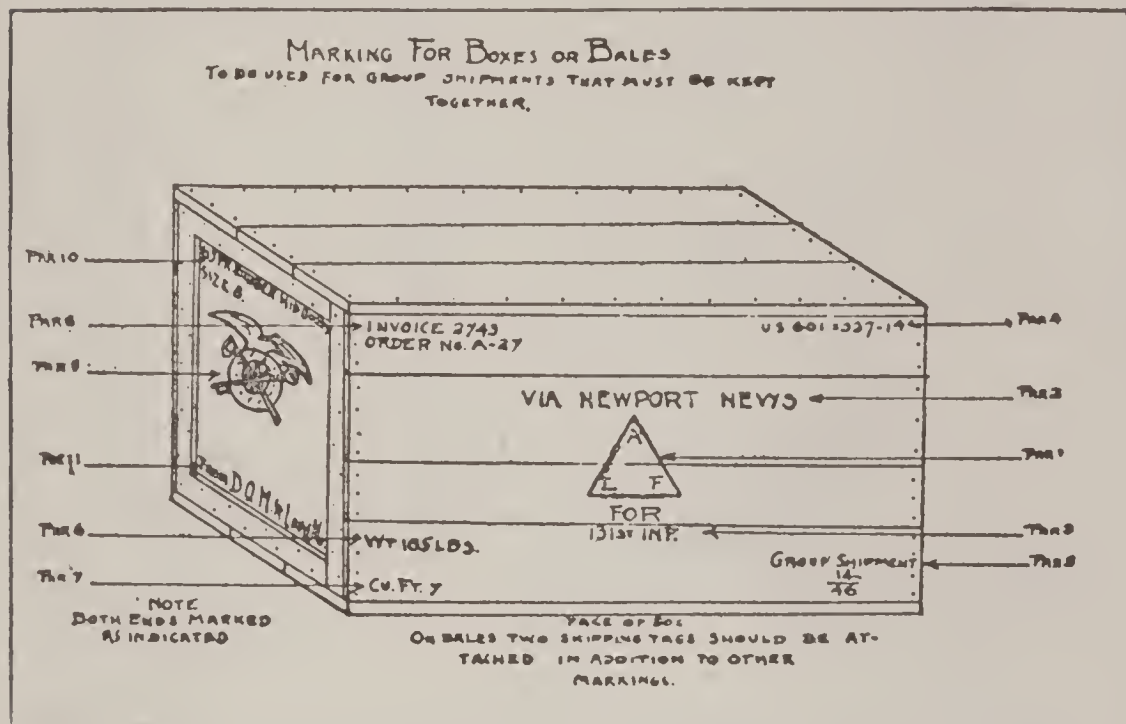
On the reverse side of this aforementioned letter, the following graphic instructions shall be shown. The figures in parenthesis refer to the standard markings on supplies to be shipped overseas, as prescribed in paragraph 1.



4. In order to indicate definitely to the shipper exactly what markings to place upon the packages of a particular shipment the necessary data to complete the letter shall be



filled in and the requisite standard markings applicable to such shipment shall be printed by hand, or typewritten in the proper places on the diagram. For convenient use the diagram should be approximately 5 inches by 8½ inches. As examples, the following diagrams are given:



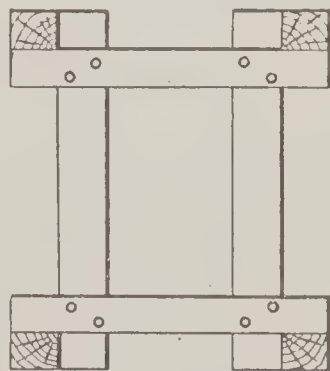
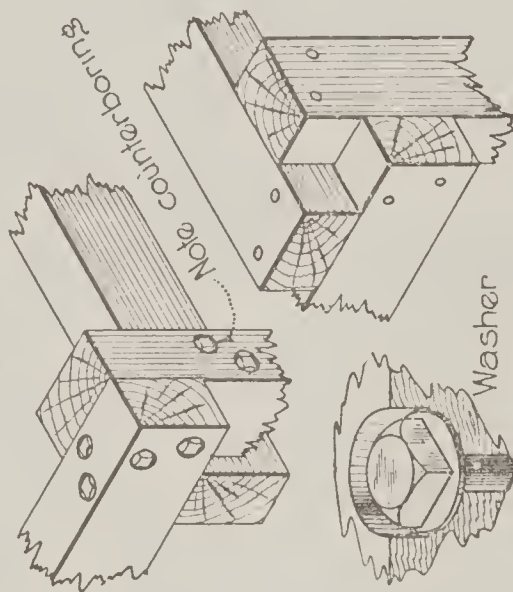


Fig. 1
Crate Construction



CORNER CONSTRUCTION

Staples or Nails not to project thru wood

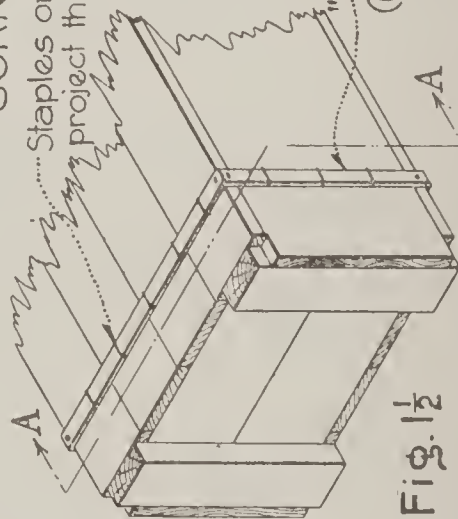


Fig. 1 1/2

"Band Iron"
(Cold rolled unan-
nealed strip steel)

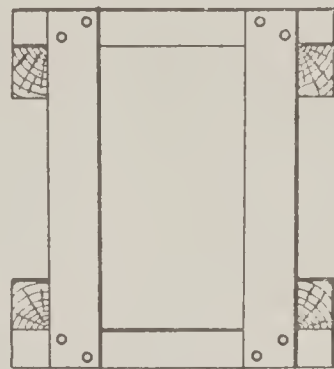


Fig. 2
Crate-Frame End



Section A-A

BAND IRON ON BOXES

Bolts counterbored

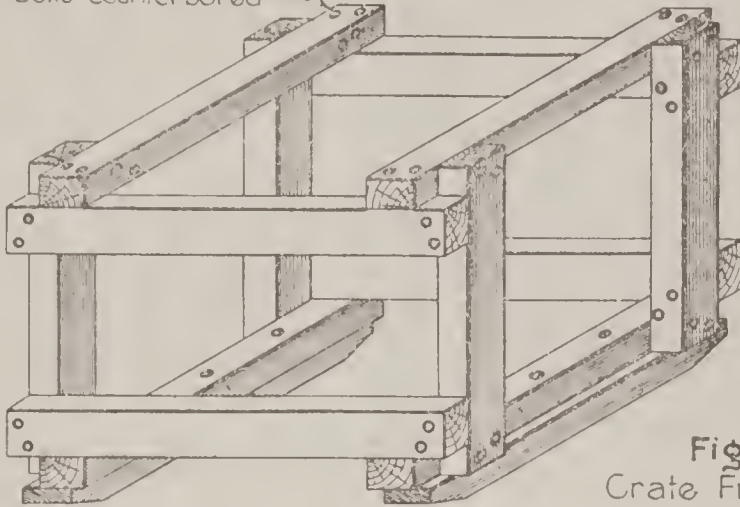


Fig. 3
Crate Framing

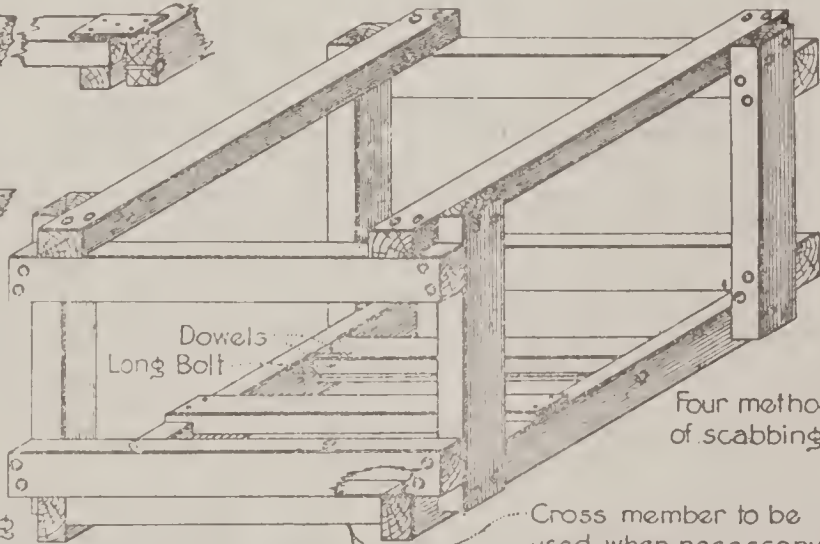
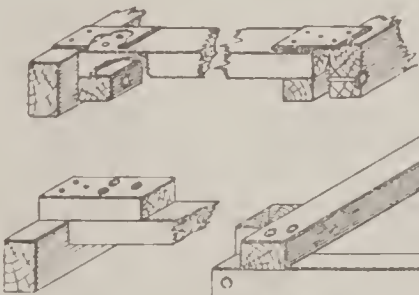


Fig. 4
Crate Framing

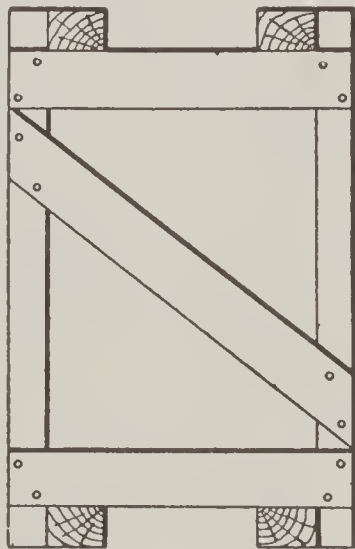


Fig. 5
Diagonal Brace for Light Crates

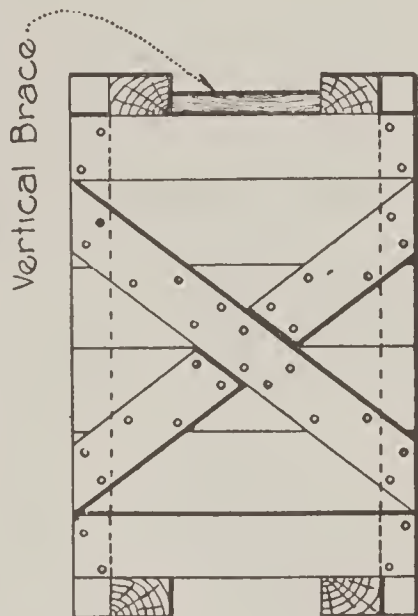


Fig. 6
End or Side showing diagonal braces

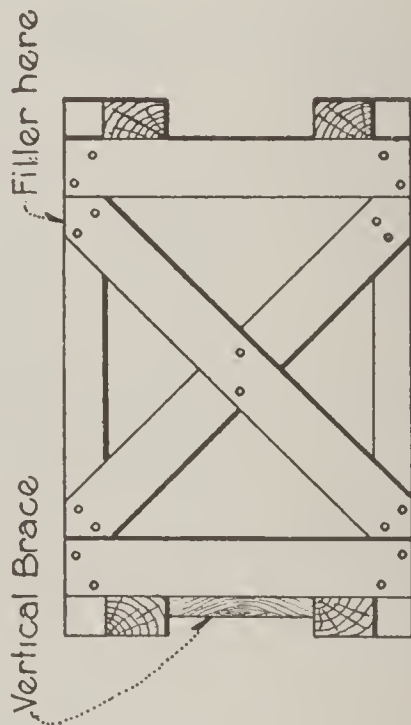


Fig. 7
Crates End or Side

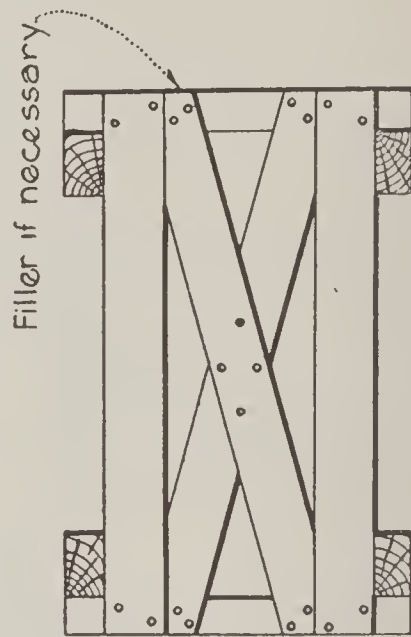


Fig. 8
Crates End or Side, showing diagonals mitered

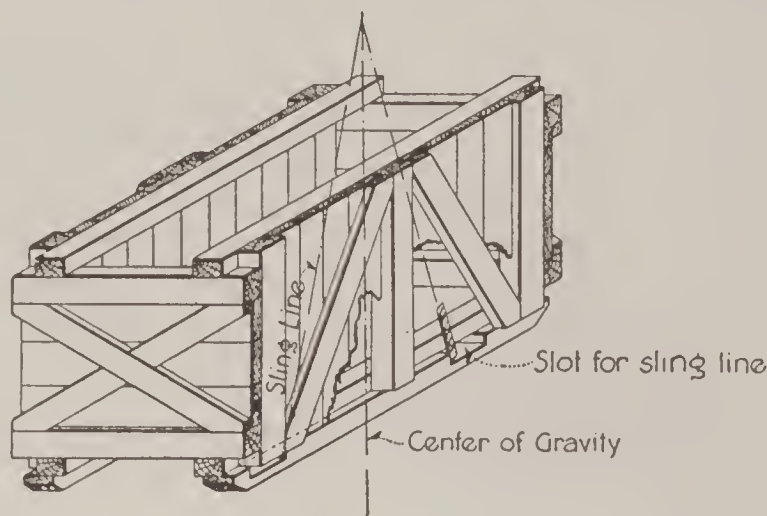


Fig. 9

Crate - Places for Sling Lines and Center of Gravity are marked



Corner Posts if needed

Fig. 10

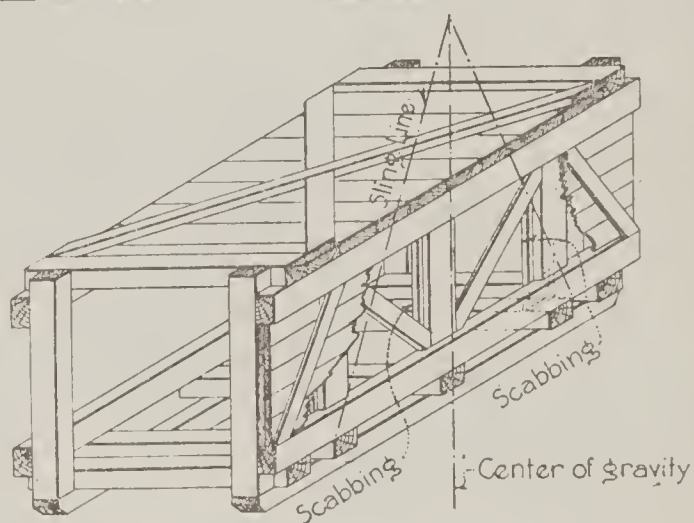


Fig.11

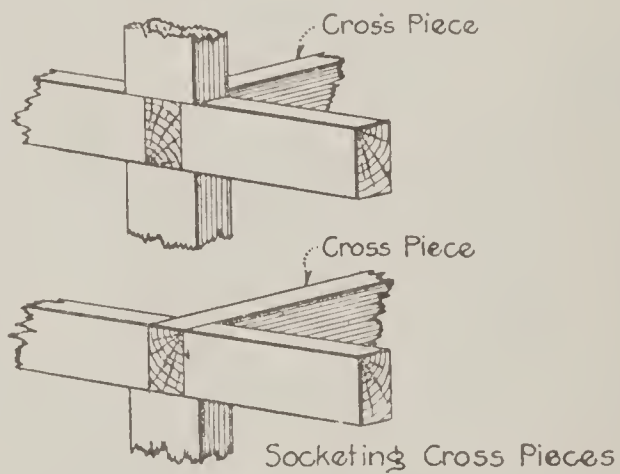


Fig.12

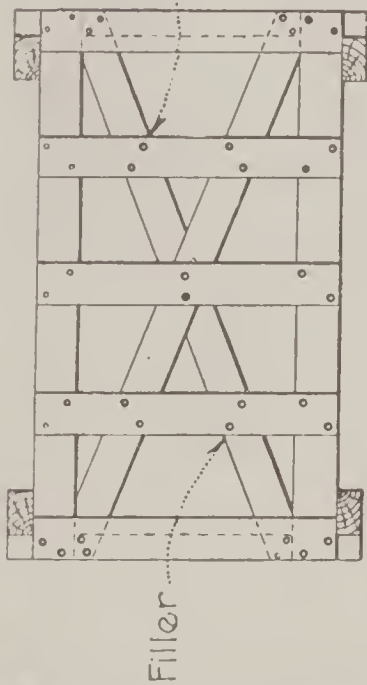


Fig. 13

Top or Side - showing support for the crossplanks which protect contents

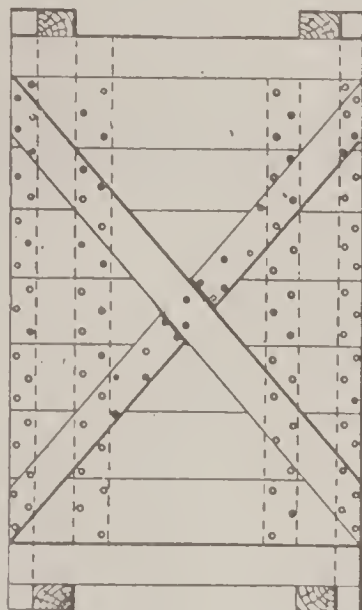


Fig. 15

Top or Side Construction

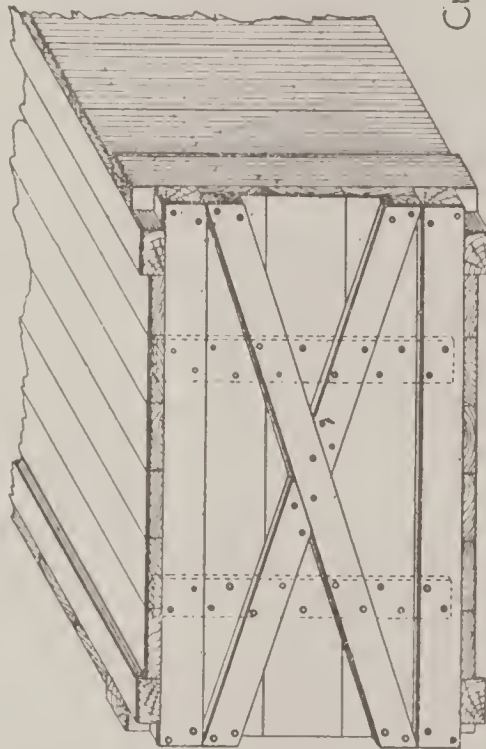
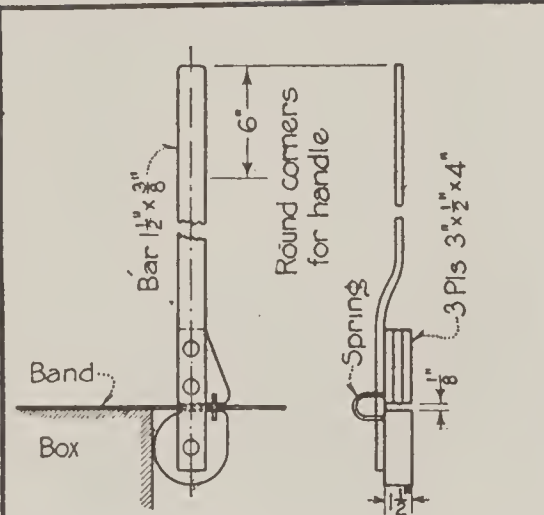
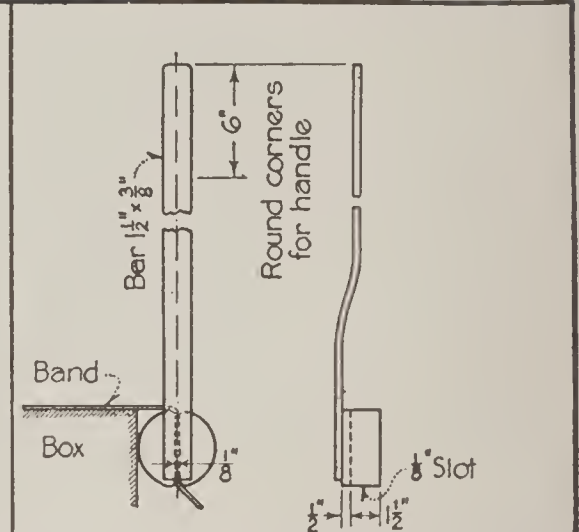


Fig. 14

Top or Side Construction
Crate turned to show top

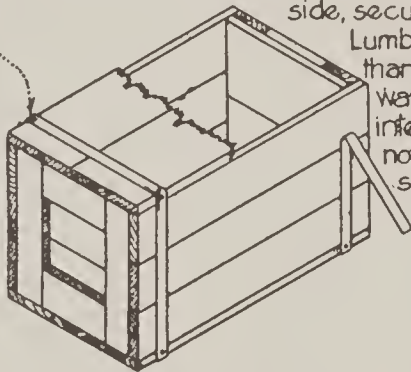


BAND STRETCHER (Not patented)
Tighten all bands by mechanical means
Fig. 16

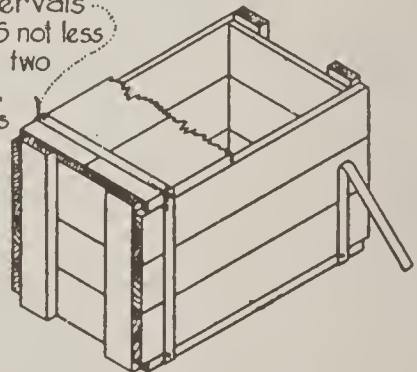


BAND STRETCHER (Not patented)
Tighten all bands by mechanical means
Fig. 17

Bands $\frac{3}{4}$ " x .020" unannealed cold rolled steel, lapped at least 4" on side, secured at 4" intervals
Lumber 1" S1S or S2S not less than $\frac{1}{8}$ " Long nails two ways at corners, intermediate nails not to go through sheathing.

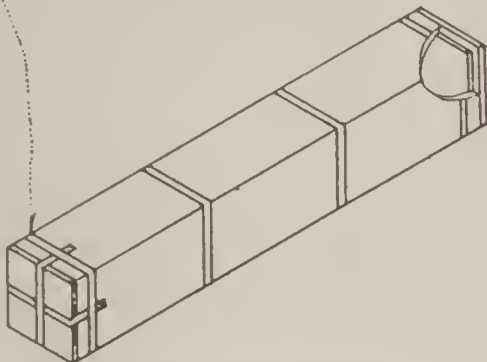


Box for up to 200# and 15 cu. ft.
Fig. 18



Box for up to 200# and 15 cu. ft.
Fig. 19

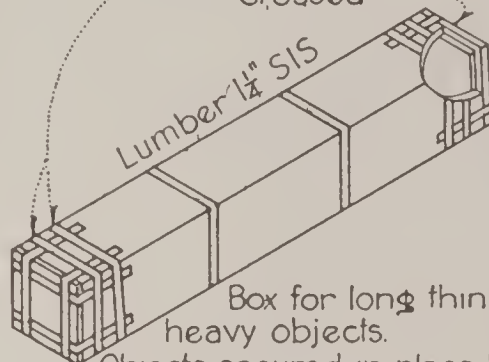
Bands $\frac{3}{4}$ " x .030" to 2" x .030" cold rolled unannealed strip steel, lapped at least 4" on side, secured at 3" to 4" intervals



Box for long thin objects

Fig. 20

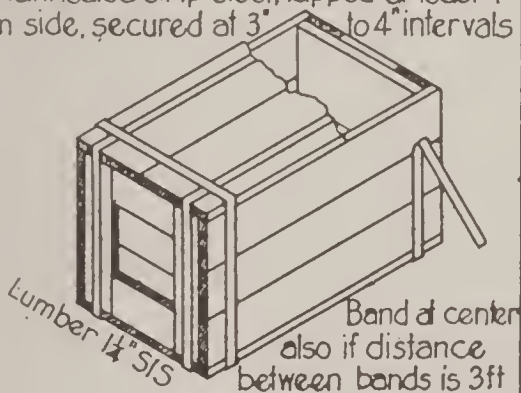
Head $\frac{3}{4}$ " thick and $1\frac{3}{4}$ " thick, grain crossed



Box for long thin heavy objects.
Objects secured in place by thin wood strips crushed in place between layers

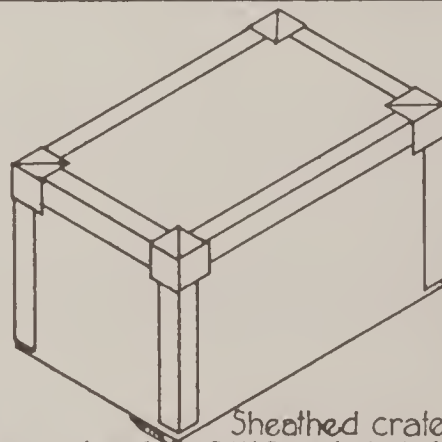
Fig. 21

Bands $\frac{3}{4}$ " x .020" to 1" x .030" cold rolled unannealed strip steel, lapped at least 4" on side, secured at 3" to 4" intervals



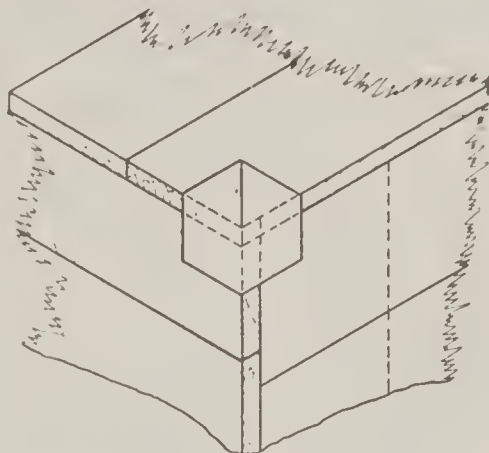
Box for up to 400* and 25 cu. ft.

Fig. 22



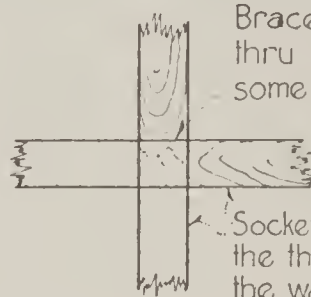
Sheathed crate
edge strips 5" x 24 B.W.G. nailed at 4" to 6" intervals each leg, cut square at ends and with corner of #20 B.W.G. metal, see Fig. 24

Fig. 23



Corner of box (bands omitted) See also Fig 23

Fig. 24



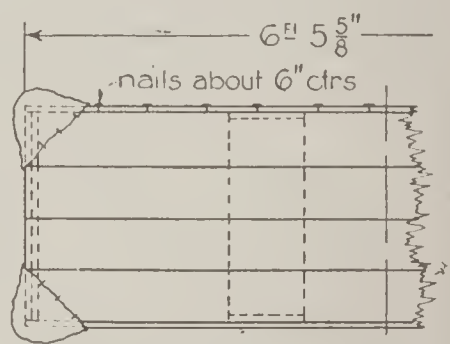
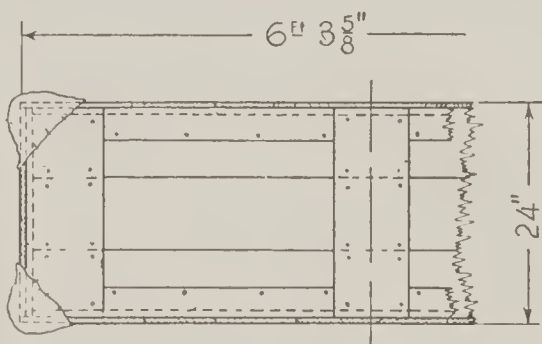
Brace piece running thru box to hold some object in place

Socket pieces to take the thrust, nailed to the walls of case

Where advisable run socket members to butt on frame as shown in Fig. 12

SOCKETING

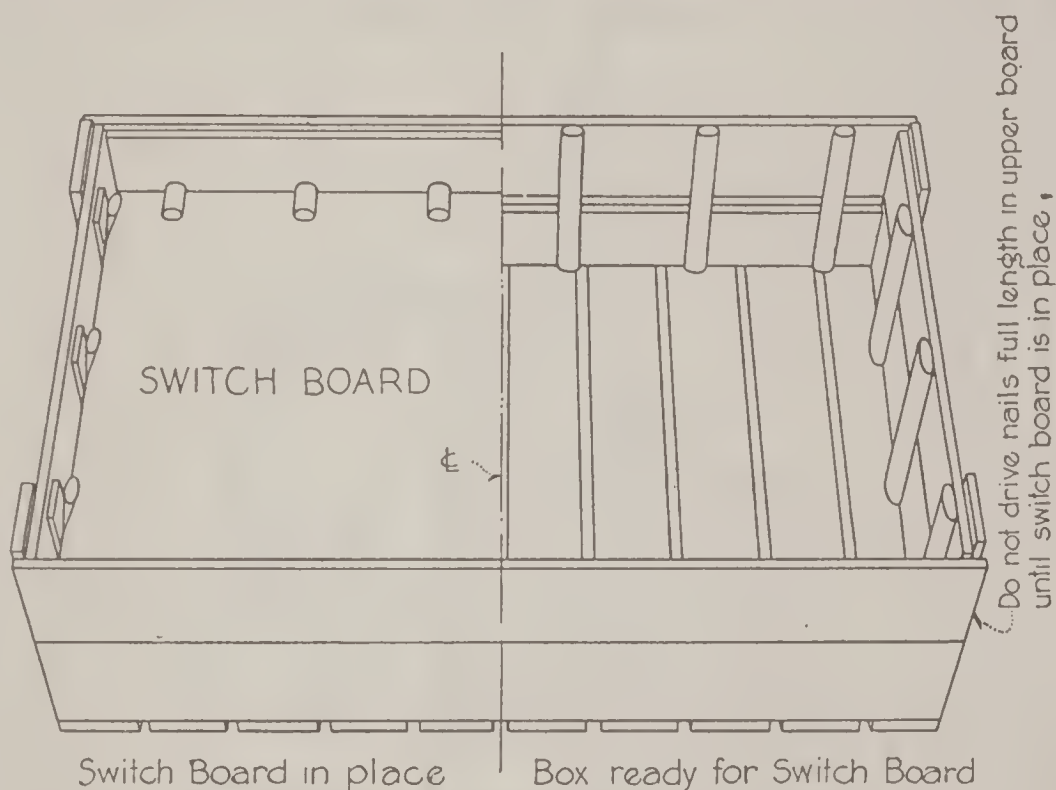
Fig. 25



Bumpers at corners, contents fragile, bumper is stout cloth nailed on and well stuffed Lumber 1" SIS or better Double cloth, if burlap is used

BOX FOR SEARCHLIGHT MIRROR

Fig. 26



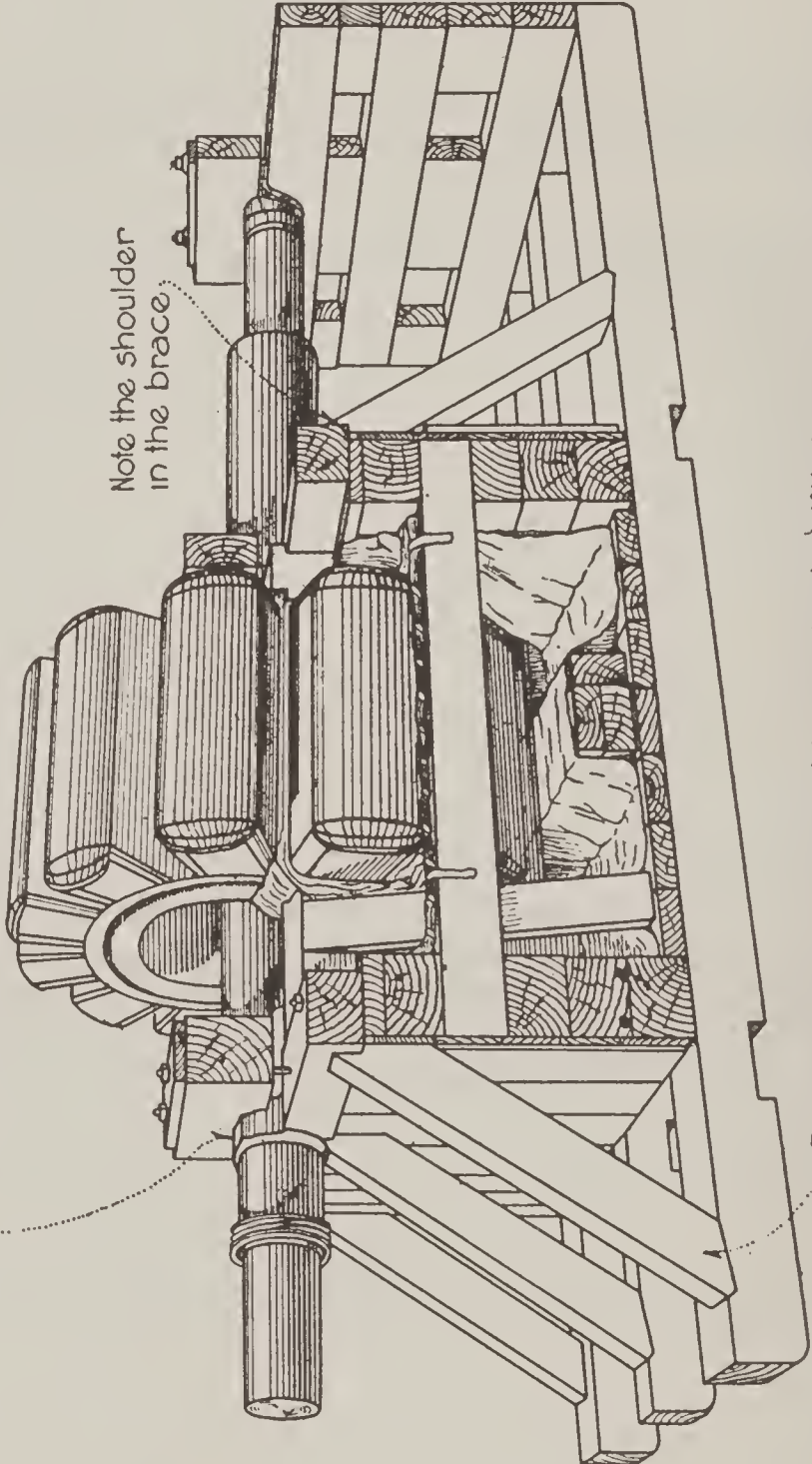
Switch Board in place

Box ready for Switch Board

Switch boards shall be packed in two boxes, the inner box being floated in the outer box, 3" clear space between, this space packed with excelsior. The inner box has supports; upon these is laid the switch board with cigarettes between; these cigarettes are two to three inches in diameter, of cloth stuffed with excelsior; pieces are then forced down over the cigarettes and nailed to the sides. The inner box is completed, floated in the outer box, and this properly secured.

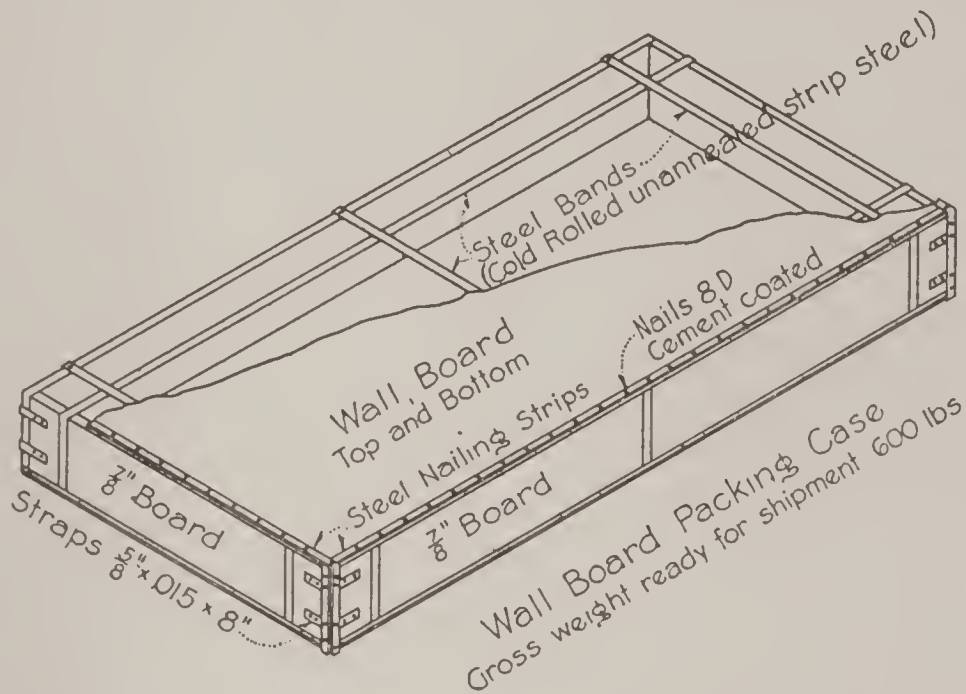
Fig. 27

Where bearings are used as supports, block supports are prepared; support points (1) will be slushed, (2) zinc plate will be laid thereon, (3) carriage cloth or oil cloth will be laid on the zinc, finished side to the zinc, and the other side slushed to receive the shaft



Piece is secured against longitudinal shifting as well as side wise

Fig. 28



- A-Sides and Ends; 1" S1S, or more if lumber is poor or splits.
- B-Steel Bands, $\frac{5}{8}$ " \times 0.15". Three are required crosswise of case and two lengthwise, as shown. These bands shall be so secured at ends as to develop 70% or more of the strength of the bands
- C-Wall Board, top and bottom, outside of steel bands as shown.
- D-Steel Nailing Strips, $\frac{5}{8}$ " \times 0.15" shall pass along sides and ends as shown and shall be nailed at four inch intervals through wall board into casing

Fig. 29.



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